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Notes:

1. Untranslatable words are replaced with asterisks (***)�.
2. Texts in the figures are not translated and shown as it is.

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Dictionary: Last updated 04/14/2009 / Priority: 1. Mechanical engineering / 2. Transportation / 3. Information communication technology (ICT)

CLAIM + DETAILED DESCRIPTION

[Claim(s)]**[Claim 1]**

He is a mobile robot which operates by remote control on radio using a cellular phone, wireless LAN, etc.,

It detected that an electric wave of radio stopped arriving during movement, movement of a robot was suspended, and it had a means to return to a possible point of wireless connection.

A mobile robot characterized by things.

[Claim 2]

When it returned to a possible point of wireless connection after moving to a wireless-communications impossible point, it had a means to report that it returned to a point in which wireless connection is possible.

A mobile robot of Claim 1 characterized by things.

[Claim 3]

It had a means to save propriety information on electric-wave communication in a map and an indoor floor plan which were saved in a robot, moving.

Claim 1 characterized by things, or a mobile robot of Claim 2.

[Claim 4]

It had a means to have moved to a point which cannot communicate, to have performed given instructions, and to return internal map information which saved [above-mentioned] to a point nearest to origin which can be electric-wave communicated.

A mobile robot of Claim 3 characterized by things.

[Claim 5]

It is a control program of a mobile robot which operates by remote control on radio using a cellular phone, wireless LAN, etc.,

The above-mentioned program makes a computer perform processing which stops movement

of a robot, and processing to which a robot is returned to a possible point of wireless connection, when an electric wave of radio stops arriving during movement.
A control program of a mobile robot characterized by things.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the mobile robot which operates by remote control on radio using a cellular phone, wireless LAN, etc.

[0002]

[Description of the Prior Art]

The art which carries out distant control of the mobile robot by radio from the former is proposed variously. For example, the patent documents 1 has disclosed the control system of the mobile robot which made the mobile robot operational even if the manual operating device and mobile robot having the function which displays the state of a robot were connected via the communication line network and the telephone line and an operator was not near the mobile robot.

The patent documents 2 has disclosed the network remote control system with which the control station operated the robot (controlled terminal) by remote control when a control station and a wireless connection terminal were connected on LAN, a wireless communication means was provided in a robot (controlled terminal) and a wireless connection terminal communicated with a robot (controlled terminal) between non-railroad sections.

When the robot had moved to the place which an electric wave does not reach, remote control became impossible, and people had no choice but to take [which operates by the above-mentioned conventional remote control] out. The mobile robot in particular that cannot use it in the environment of a home, an office, etc. if a radio wave state always is not superior is not realistic.

[0003]

[Patent documents 1]

JP,H5-91556,A

[Patent documents 2]

JP,2000-49800,A

[0004]

[Problem to be solved by the invention]

As described above, when the robot moved to the place which an electric wave does not reach, there was a problem that remote control became impossible, by the mobile robot which

operates by the conventional remote control.

Are made in order that this invention may solve the problem of the above-mentioned conventional technology, and, [the purpose of this invention] Also after moving to the place which prevents a mobile robot's moving to the place which an electric wave does not reach, and operation becoming impossible, and an electric wave does not reach, it is returning till the place which an electric wave reaches and enabling resumption of operation.

[0005]

[Means for solving problem]

In the mobile robot which operates by remote control on radio in this invention in order to solve the above-mentioned technical problem, When it moves while the mobile robot supervised the radio wave state and saved the information, and the electric wave of radio stops arriving during movement, movement of a robot is stopped and a means to return to the possible point of wireless connection is formed.

By having the above-mentioned composition, when communication becomes impossible, it can return to the possible point, and thereby, the radio mobile robot can be in the state which can always be operated by remote control.

It can also constitute as follows.

(1) When it returns to the possible point of wireless connection after moving to a wireless-communications impossible point, a means to report that it returned to the point in which wireless connection is possible is formed. Thereby, the user can know the mobile robot having moved to the place which an electric wave does not reach temporarily, and having returned to it.

(2) Form a means to save the propriety information on electric-wave communication in the map and indoor floor plan which were saved in the robot, moving.

Thereby, an electric-wave intensity map can be created. If this electric-wave intensity map is used, it will become possible to select the moving trucking which can communicate.

Even when a mobile robot moves to the place which an electric wave does not reach, it can move to the near position close to No. 1 which can communicate promptly.

(3) Form a means to move to a point which cannot communicate, to perform given instructions, and to return internal map information which saved [above-mentioned] to a point nearest to origin which can be electric-wave communicated.

Even when this moves to a point which cannot communicate, given instructions can be completed and it can move promptly to the nearest point that can communicate.

[0006]

[Mode for carrying out the invention]

Drawing 1 is a schematic diagram of a system of a work example of this invention. As shown in the figure, radio devices, such as a wireless LAN card, a cellular phone, BlueTooth, are

connected to the mobile robot 1 of this example, and it comprises software on an information management system so that network connection may be possible.

With the terminals 2, such as a personal computer and a cellular phone, the mobile robot 1 has a user at environment connectable with the network 3. Software which can operate the mobile robot 1 via a network from remoteness, or can know the mobile robot's 1 condition is installed in the terminals 2, such as a user's personal computer and a cellular phone.

When the mobile robot 1 connects with a network by dial-up connection by a cellular phone, Since IP addresses got from a provider differ in a dial-up degree, Software on a robot is always accessing possible by regular domain names (mycomputer.mydomain.com etc.) by notifying an IP address got from a Dynamic-DNS server, without notifying a user of an IP address.

For example it is put on a user's house etc., and a user moves the mobile robot 1 by the instructions from the terminal 2, or. [the mobile robot 1] Electrical household appliances and electrical equipment etc. are operated with the infrared receipt of letter / transmitter carried in the mobile robot 1, and the situation of a house, etc. are supervised with the camera etc. which were prepared for the mobile robot 1.

[0007]

Drawing 2 is a figure showing the above-mentioned mobile robot's example of composition.

The substrate 1a in which the mobile robot 1 carried CPU as shown in the figure, the motor 1b for movement, The infrared dispatch / receiver 1e for operating ROM1c which memorizes a program and data, the motor 1d for movement, electrical household appliances and electrical equipment, etc., It comprises 1g of storage devices etc. which save the radio devices 1f, such as the above mentioned wireless LAN and cellular phone, and BlueTooth, migration length, map information, etc. (a hard disk, a compact flash, etc.).

A device called the sensor 1i which measures the camera 1h which photos the surrounding situation for remote control etc., distance, etc. may be connected, The push button switch 1o for making operation start LED1n for displaying the microphone 1j, the loudspeaker 1k, the liquid crystal display 1m, a state, etc. and the mobile robot 1, or performing various setting out, the pointing device 1p, the battery 1q, etc. may be carried.

The mobile robot 1 works operating electrical household appliances and electrical equipment etc., as the instructions which a user sends out via the network 3 are received and were moved and described above according to the received instructions with the above-mentioned radio devices 1f, or supervising the surrounding situation etc.

In carrying the cellular phone in the mobile robot 1 and connecting it with a network using a public network by dial-up, As described above, a dynamic DNS server is on a network, and the IP address assigned to the server by the provider and the domain name hit to it can be registered and updated. A robot can be telephoned when the cellular phone is carried in the robot.

The above-mentioned mobile robot's 1 control is performed when CPU by which the control program memorized by said ROM1c was carried in CPU substrate 1a performs, and the data of the mobile robot's 1 moving trucking information, a radio wave state, various log information, etc., etc. is memorized by 1 g of the above-mentioned storage devices. Below, the portion which controls the mobile robot which comprises an above-mentioned CPU etc. is called control section.

[0008]

Drawing 3 is a block diagram showing the functional composition of the mobile robot of this example.

As shown in the figure, [a mobile robot's control section 11] The transmission and reception section 12 connected to the radio devices 1f, and the operating-command part 13 which changes into the mobile robot's 1 operating command the instructions received by the transmission and reception section 12, and outputs an operating command, Based on the operating command which the operating-command part 13 outputs, it has the drive control section 14 for driving operation equipment and the motors 1d for movement, such as infrared dispatch / receiver 1e.

.Till the place which an electric wave reaches when it has moved to the storage part 16 which makes the radio wave state judgment part 15 which judges the radio wave state received by the transmission and reception section 12, a radio wave state, etc. correspond with moving trucking, and memorizes them, and the place which an electric wave does not reach [the mobile robot 1]. It has the operation pattern preparing part 17 which creates the operation pattern for moving the mobile robot 1, and the return operation check part 18 which checks having completed return operation.

And a mobile robot memorizes moving trucking information, a radio wave state, etc. to the above-mentioned storage part 16 while recognizing a self position based on the distance etc. which were measured by the initial position and said sensor 1i, moving.

[0009]

Drawing 4 is a flow chart which shows the processing in the mobile robot of this example.

A mobile robot's radio wave state judgment part 15 is always supervising the radio wave state. As for a mobile robot, movement will be started if there is an event of there having been directions from a remote user or the time specified beforehand having come (Step S1 of drawing 4) (Step S2).

And storage and preservation of the migration length and the direction of [by the present] is carried out to the mobile robot's 1 storage part 16 with the radio wave state for every fixed time, moving (Step S3). Directions will be succeeding, if all movement is ended while the radio wave state has been good (step S4-6).

[0010]

When a radio wave state gets worse during movement, it goes to Step S7 from Step S4, and stops there, and migration length/the direction of [front] is acquired from the storage part 16 in order to return to a front position (Step S8). And an operation pattern is created by the operation pattern preparing part 17, and movement is performed (Step S9, S10). Here, an operation pattern is equivalent to the moving pattern of mobile robots, such as 50 cm of sternway, or 180-degree reversal, 50 cm of advance, when pre-operation is 50 cm of advance, for example.

If it returns to a front position, a radio wave state will be checked (Step S11). When the mobile robot carries the cellular phone, network re connection is tried by a dial-up in the position. And if it succeeds, it will stop at the place (Step S12).

in addition -- although messages, such as e-mail, were sent and it once came out to the electric-wave outside of the circle, after network re connection succeeded in the last of the above-mentioned move procedure -- **** which can be operated by remote control again -- it may be reported that things were notified, or it returned to it, having telephoned the specification telephone number when it was the robot to which the cellular phone was connected.

[0011]

A robot has map information, such as a floor plan, compares a landmark from the picture of the photoed surroundings, deduces a self position, deduces the move direction and distance to a target position which were directed with the coordinates on a map based on it, and may be made to carry out autonomous movement.

Under the present circumstances, the electric-wave intensity in each coordinate point under movement is acquired and saved. The electric-wave intensity map in each position is created as are shown in drawing 5 and the mobile robot 1 moves by this. A user may teach from remoteness, and the mobile robot 1 observes the surrounding situation with the camera 1h, and it may be made for the first self position to deduce a self position.

When creating the electric-wave intensity map as mentioned above and it is in a position with weak electric-wave intensity after ending the operation the mobile robot 1 was instructed to be using the created electric-wave intensity map, it moves to a position with the nearest, strong electric-wave intensity automatically, and it becomes possible to restore network connection.

[0012]

Drawing 6 is a flow chart which shows the processing in the mobile robot in the case of moving to a position with the nearest, strong electric-wave intensity automatically as mentioned above using an electric-wave intensity map.

If there is an event of there having been directions from a remote user or the time specified beforehand having come (Step S1), a mobile robot will acquire a circumferential image with the camera 1h (Step S2), will perform collation with map information, and will deduce a self

position (Step S3). A user may be made to teach a mobile robot's position based on the picture acquired from the camera in that case.

Subsequently, a mobile robot computes a moving pattern from a target position and a self position, and starts movement (Step S5).

And storage and preservation of the migration length and the direction of [by the present] is carried out to the mobile robot's 1 storage part 16 with the radio wave state for every fixed time, moving (Step S6). If all the movements are ended (Step S7), as described above, electrical household appliances and electrical equipment etc. will be operated (Step S8), and it will be judged whether electric-wave intensity is good (Step S9). If the radio wave state is good, it will serve as a move success and will end processing (Step S10).

When a radio wave state is not good, it goes to Step S11 from Step S9, and is set as $x=11$, and the electric-wave intensity of the circumference x is checked on map coordinates from a self position (Step S12). And it investigates whether there are any coordinates with good sensitivity, and if not good, the parameter x will be carried out +1 (Step S16), and it will return to Step S12. Carrying out a parameter +1 as mentioned above, on map coordinates, if it asks for the place where sensitivity is good and there are coordinates with good sensitivity, it will go to Step S14 from Step S13, a target position will be set up from map coordinates, and movement will be started (Step S14). And processing will be ended if a move success is carried out.

in addition -- although messages, such as e-mail, were sent and it once came out to the electric-wave outside of the circle like said work example in the above -- **** which can be operated by remote control again -- it may be made to report that things were notified, or it returned to it, having telephoned the specification telephone number when it was the robot to which the cellular phone was connected

After moving to a target spot and doing the work of household appliance operation etc. by making it above, it becomes possible not to fall into a remote control impossible state, even if the point is a place which an electric wave does not reach.

[0013]

[Effect of the Invention]

In the mobile robot which operates by remote control on radio in this invention as explained above, Since it was made to return a mobile robot to the possible point of wireless connection when move ROBOTSU supervised a radio wave state and the electric wave of radio stopped having arrived during movement, a radio mobile robot can be changed into the state which can always be operated by remote control.

[Brief Description of the Drawings]

[Drawing 1]It is a schematic diagram of the system of the work example of this invention.

[Drawing 2]It is a figure showing the example of composition of the mobile robot of the work

example of this invention.

[Drawing 3]It is a block diagram showing the functional composition of the mobile robot of this example.

[Drawing 4]It is a flow chart which shows the processing in the mobile robot of this example.

[Drawing 5]It is a figure showing an example of an electric-wave intensity map.

[Drawing 6]It is a flow chart which shows the processing in the mobile robot in the case of moving to a position with the nearest, strong electric-wave intensity automatically.

[Explanations of letters or numerals]

1 Mobile robot

2 Terminal

3 Network

11 Control section

12 Transmission and reception section

13 Operating-command part

14 Drive control section

15 Radio wave state judgment part

16 Storage part

17 Operation pattern preparing part

[Translation done.]